Section 3 - Overview of the Existing Air Monitoring Networks

This overview section is provided as context and reference which will facilitate understanding of the recommended network modifications discussed through the remainder of this report. The major routinely operating ambient air monitoring networks in the United States include a collection of programs primarily operated by the SLT's:

3.1 State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS)

SLAMS and NAMS represent the majority of all criteria pollutant (SO_2, NO_2, CO, O_3, Pb, $PM_{2.5}$, PM_{10}) monitoring across the nation with over 5,000 monitors at approximately 3,000 sites. These stations use Federal reference or equivalent methods (FRM/FEM) for direct comparison to the NAAQS. Design and measurement requirements for these networks are codified in 40 CFR Part 58 (design and quality assurance), Part 53 (equivalent methods), and Part 50 (reference methods). NAMS are a subset of SLAMS that are designated as national trends sites. The NAMS and SLAMS were developed in the 1970's with a major addition of $PM_{2.5}$ monitors starting in 1999 associated with promulgation of the 1997 PM NAAQS. These networks experienced accelerated growth throughout the 1970's with most components exhibiting declines in the number of sites with the exception of ozone and $PM_{2.5}$ (Figure 3-1 and also Table 3-1). Rethinking the design of SLAMS/NAMS is a central topic of this strategy.

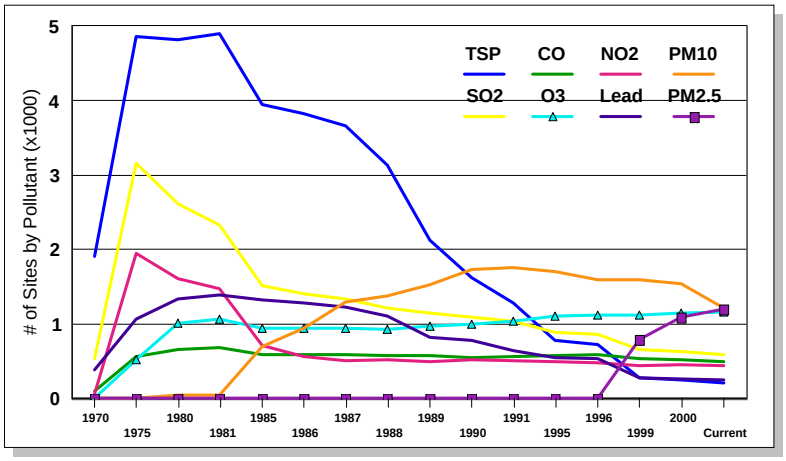

Figure 3-1. Growth and decline of criteria pollutant networks.

3.1.1 $PM_{2.5}$ Networks

The $PM_{2.5}$ networks include three major components (Figure 3-2):

- **mass only measurements** through nearly 1,100 FRM filter based mass sites [Figure 3-3] that measure 24-hour averaged concentrations through gravimetry, and approximately 200 continuously operating mass sites using a range of technologies;

- **chemical speciation measurements** that consists of approximately 54 trend, 175 State Implementation Plan (SIP), and 150 IMPROVE sites (Figure 3-4), respectively. The vast majority of these sites collect aerosol samples over 24 hours every third day on filters that are analyzed for trace elements, major ions (sulfates, nitrates, and ammonium) and organic and elemental carbon fractions. Most of the IMPROVE sites are operated by personnel from the Federal Land Management (FLM) and Forest and National Park Services. Over the last five years, these networks have been subject to reviews by the National Academy of Sciences (NAS), EPA's CASAC, the General Accounting Office (GAO), and the Inspector General's Office. The CASAC review by the particle monitoring subcommittee has been engaged with EPA since 1999. Many of the recommendations related to the introduction of new methodology, particularly increased continuous particle monitoring and the corresponding need to redirect resources from FRM filter methods to continuous and speciation sampling have been addressed in detail through the CASAC Subcommittee on Particulate Matter Monitoring; and

- **eight supersites** executed as cooperative agreements with universities and EPA that operate over various periods spanning 1999 to 2005 and conduct a wealth of standard and research grade measurements. Supersites are designed to address the extremely complicated sampling issues associated with fine aerosols and constitute an ambitious technology transfer and liaison effort across research level and routine network operations.

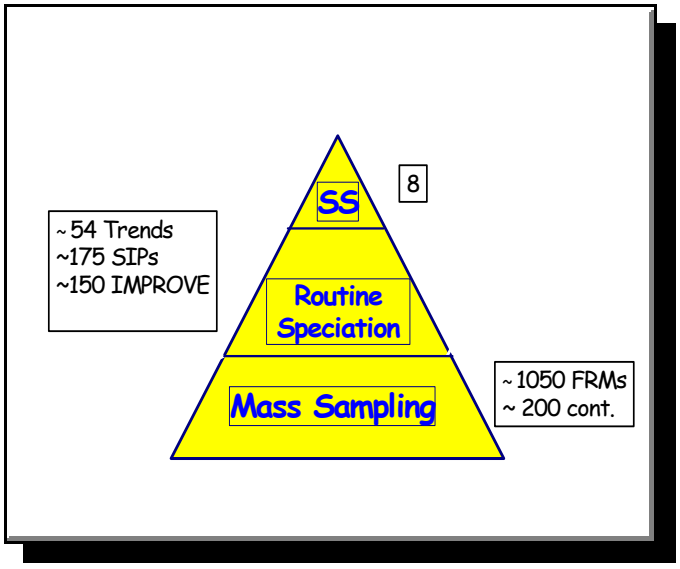

Figure 3-2. $PM_{2.5}$ Monitoring Network Elements.

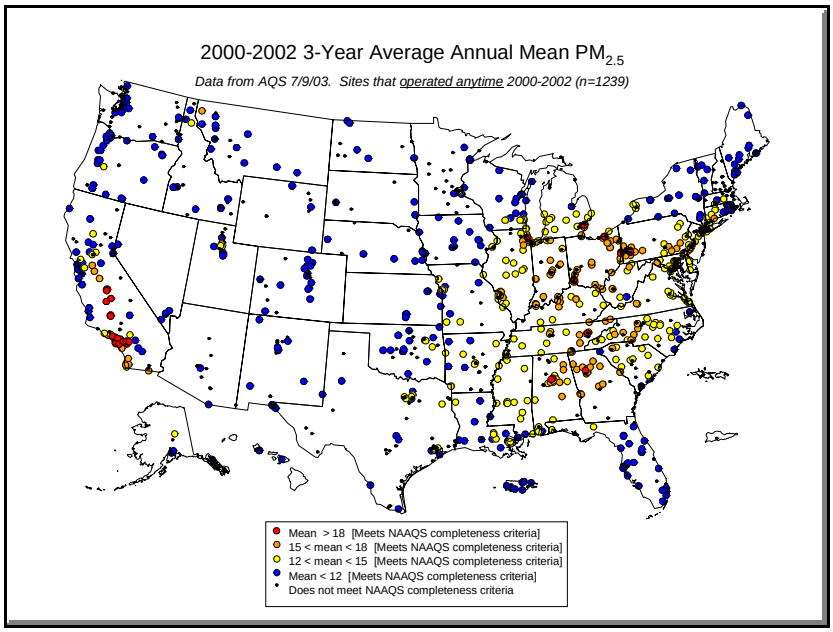

Figure 3-3. $PM_{2.5}$ FRM monitoring sites.

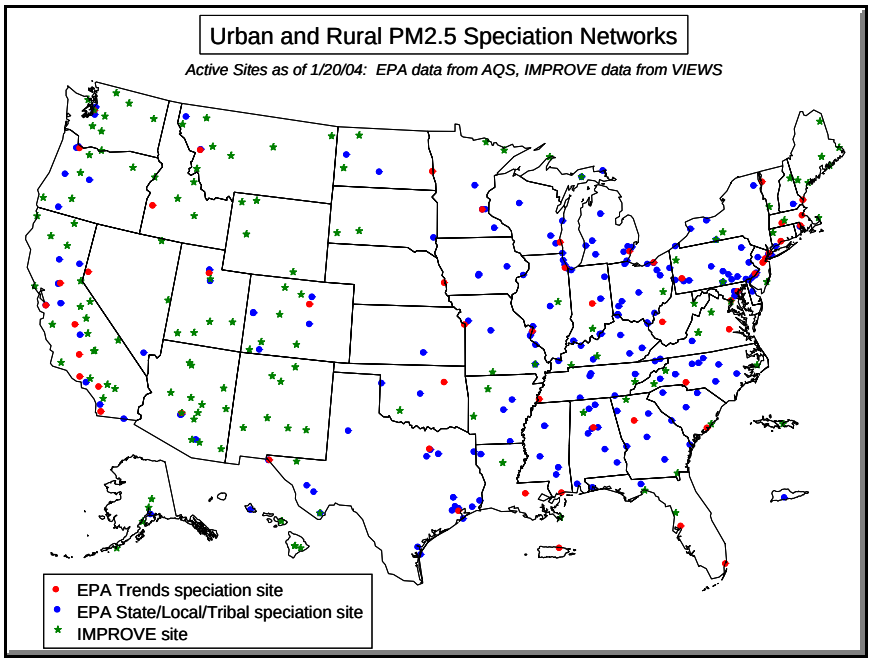

Figure 3-4. $PM_{2.5}$ Chemical Speciation Sites.

3.2 Clean Air Status and Trends Network (CASTNET)

CASTNET originally was designed to account for progress of strategies targeting major electrical generating utilities throughout the Midwest which release acid rain precursor emissions, sulfur, and nitrogen oxides. Network operations are contracted out to private firms funded through Science and Technology (S&T) funds and managed by EPA's Office of Air and Radiation. CASTNET consists of approximately 70 sites located predominantly throughout the East with greatest site densities in States along the Ohio River Valley and central Appalachian Mountains (Figure 3-5). Aggregate two week samples are collected by filter packs and analyzed for major sulfur and nitrogen oxide transformation compounds (e.g., end products such as sulfate and nitrate ions). CASTNET was deployed in the 1980's as part of EPA's National Acid Precipitation Assessment Program (NAPAP). A network assessment in the mid-1990's lead to a more optimized and less extensive network.

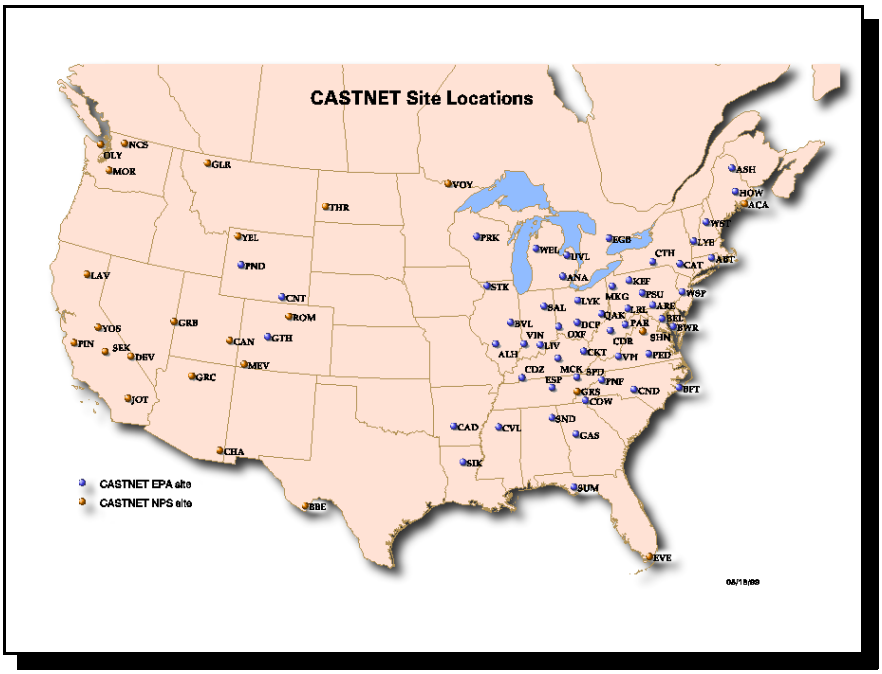

Figure 3-5. Clean Air Status and Trends Network (CASTNET).

3.3 PAMS

PAMS measures ozone precursors (i.e., volatile organic compounds (VOC) and nitrogen oxides (NO_x) which react to form ozone) at 75 sites in 25 metropolitan areas that were classified as serious ozone nonattainment coincident with release of the 1990 Clean Air Act (CAA) amendments (Figure 3-6). The addition of PAMS in the early to mid-1990's was a major addition to the national networks, introducing near research grade measurement technologies to produce continuous data for over 50 VOC compounds during summer ozone seasons. PAMS has been subject to numerous concerns regarding data quality and lack data analysis applications. More recent efforts have explored stronger linkage to air toxics monitoring as well as identification of more streamlined PAMS requirements.

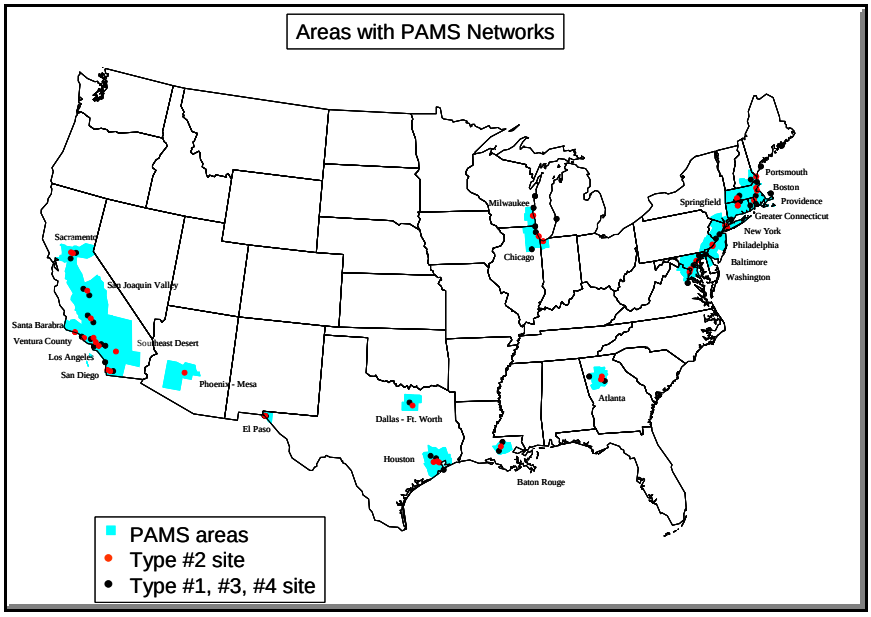

Figure 3-6. Locations of Photochemical Assessment Measurements Stations (PAMS).

3.4 Air Toxics Monitoring Network

Nearly 250 air toxics sites have been operated by State and local agencies largely through their own initiatives and funding as there are no Federal requirements for air toxics monitoring, and only recently have Federal Grant funds been earmarked for such monitoring. A Steering Committee consisting of EPA, State, and local agency members has been developing a National Air Toxics monitoring program. The program design effort is starting with a detailed analysis of data from existing sites and recently deployed pilot studies (measuring 18 species) at four major urban locations (Providence, RI; Tampa, FL; Detroit, MI; Seattle, WA) and six small city/rural locations (Puerto Rico; Keeney Knob, WV; Cedar Rapids, IA; Grand Junction, CO: Rio Rancho, NM; San Jacinto, CA). While air toxics clearly is a problem of national scope, the problems are

highly variable and dependent on location conditions (i.e., emissions mix, topography, meteorology). A majority of resources should be under the discretion of SLTs to accommodate the variable and localized nature of air toxics across the Nation. A fraction of the program will support a national trends network that measures a limited number of species at perhaps 20-30 locations. Pilot city studies were initiated in 2001 to develop a consistent data base to support a national network design. The Steering Committee has recommended an initial 10- 20 urban and rural sites to start this network (Figure 3-7) .

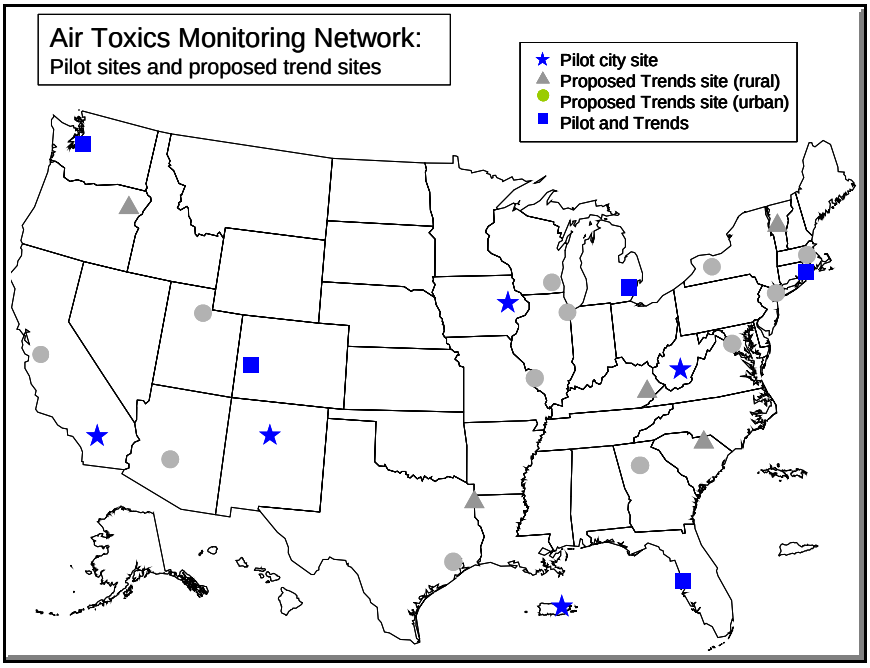

Figure 3-7. National Air Toxics Monitoring Network.

3.5 Tribal Monitoring

Tribal land monitoring (Figure 3-8) continues to increase in the number of tribes that operate monitors and the number of parameters that are measured. As of August 2002, approximately 46 sites exist for which some data are reported to EPA's AQS. This number reached approximately 50 by the end of 2002. Included in this number are 6 ozone monitoring sites; 24 PM_{10} and $PM_{2.5}$ fine mass sites; and 2 $PM_{2.5}$ chemical speciation sites. The sites also include a large number of accompanying meteorological measurements and several monitor for VOC and/or toxic chemicals. There are 2 existing IMPROVE fine mass speciation sites for regional haze measurements and 11 more sites should be added within the next year.

3.6 Summary

The preceding discussions help to set the existing air monitoring framework from which the Strategy is developed. Accordingly, the elements of the Strategy are detailed in the next six sections.

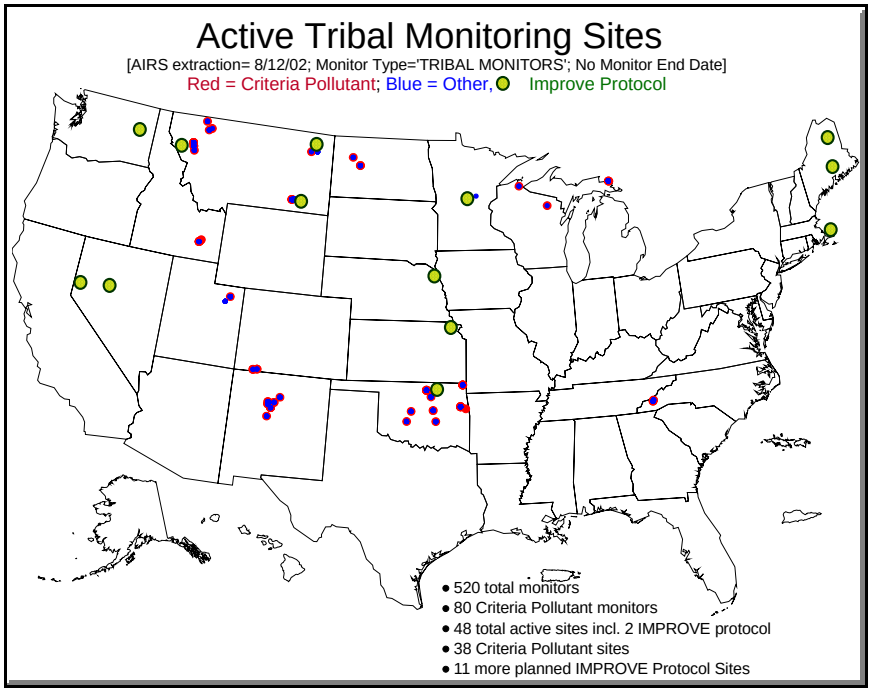

Figure 3-8. Tribal Monitoring Sites.

Table 3-1. Summary table of national ambient air monitoring networks.

SLAMS/ NAMS	Approximate Current Number of Sites	% Measuring > 60% NAAQS	Historical High # Sites	Sampling Reporting Freq. (Year Found Unless Noted)	Notes
Ozone	1167	> 80 (8 hr)	1167 (2002)	hourly (May - September)	
$PM_{2.5}$	1200	> 75	1200 (2002)	24-hr average; mix of daily, every third day and every sixth day	
PM_{10}	1214	< 25	1763 (1991)	mix of 24-hr. Avg., every sixth day; and hourly	
SO_2	592	< 5	3158 (1975)	hourly	
NO_2	437	< 5	1944 (1975)	hourly	
CO	498	< 5	684 (1981)	hourly	
Pb	247	< 5	1393 (1981)	24-hr. Avg., every sixth day	
TSP	215	NA	4894 (1981)	24-hr. Avg., every sixth day	
$PM_{2.5}$					
FRM mass	(1200)				as above
Continuous mass	200	NA		hourly	
Speciation	54 trends; 175 SIP, 150 IMPROVE	NA		mostly 24-hr. Avg.; every third day	major ions (sulfate, nitrate, ammonium); carbon fractions (organic and elemental); trace metals
PAMS	75 sites in 25 MSA's	NA		mix of hourly, 3-hr. Avg. and 24-hr. Average (56 VOC's, TNMOC and carbonyls throughout ozone season	ozone and NO_2 include in SLAMS/ NAMS
Toxics	250 (22 National Trend sites)	NA		broad range of metals, VOC's, SVOC's; Pilots: 18 species (metals, VOC's, aldehydes); 24-hr. Avg., every sixth or twelfth day	
CASTNET	70	NA		total nitrate, sulfate, ammonium 2-week avg. samples collected continuously	ozone and IMPROVE measurements included above